

IUE Final Report

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PROJECT NAME: HOT STARS (IUE)

FOR THE PERIOD ENDING JULY 1990 ✓

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This final report covers the project entitled "A Study of B supergiants" and includes activity by the Co P.I's., Catharine D. Garmany(University of Colorado) and Edward L Fitzpatrick (University of Colorado and Princeton University). This project has consisted of two parts: a study of the energy distribution of several very lightly reddened B-type supergiants in the Milky Way galaxy and an energy distribution study of the most lightly reddened B supergiants in the Small Magellanic Cloud (SMC). Both studies are being carried out in conjunction with a longer term investigation of the continuum properties of supergiants in the Large Magellanic Cloud.

In the Magellanic Clouds, the low reddening both internal and along the line of sight has permitted surveys of all of the brighter blue stars: the catalogue by Rousseau et. al.(1978) for the LMC and by Azzopardi and Vigneau (1982) for the SMC, augmented by new spectral classification (Garmany, Conti and Massey 1987) have led Garmany and Fitzpatrick (1989) to note an effect with important implications for stellar evolution

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models. Using a compilation of all published photometric and spectroscopic data for type O through G supergiants and giants in the LMC, we have shown that the H-R diagram has a pronounced discontinuity or ledge in the region of the blue supergiants. As the stellar data set is complete to a limiting magnitude, such a ledge can best be interpreted as marking a feature in the evolution of supergiants. We have discussed this in more detail (Fitzpatrick and Garmany, 1990) and addressed the implications for stellar models. The progenitor of SN 1987A lies very close to this ledge. This is discussed in more detail in Fitzpatrick and Garmany, 1990, and highlights the importance of the present study.

Due to their extreme brightness in the UV, the Milky Way supergiants had to be observed using the "fast trail" technique for low-dispersion observations. The observations were begun in late 1987 and completed in March 1988. After about half the observing was finished, the IUE Observatory adopted a new ITF table and a new absolute calibration for the LWP camera. Because this project requires absolute fluxes of the highest precision possible, and requires homogeneity in the data processing, all data which were processed before the changes in the calibrations were submitted for reprocessing. Due to the large demand for reprocessing, the data were not reprocessed till autumn 1988. All of the data have now been reduced. These included summing up multiple exposures in each camera, splicing LWP and SWP data together, and deredding the continuum fluxes. A preliminary analysis of the continuum properties, thru fitting of the continua with line blanketed model atmospheres, was completed and initial estimates of the effective temperatures and surface gravities was obtained. Results for the newly observed stars -- ζ Ori, ϵ Ori, κ Ori, and β Ori -- will be combined with results for two other lightly reddened Milky Way supergiants which were already available in the IUE Archives -- σ CMa and η CMa. The energy distributions for these six stars will be discussed in a paper scheduled to be completed this summer.

The observing for the SMC supergiants was begun and completed in last December 1989 - after the calibration changes for the LWP data were already in place. For the individual stars, the multiple exposures have been combined and the long and short wavelength spectra spliced together. The IUE Archives contain spectra for a number of other SMC supergiants. These data were ordered from the IUE Archives in Spring 1988 and submitted for reprocessing, to assure homogeneity in the data sample. The final spectra were received in Autumn 1988. The analysis of the continua is awaiting the calculation of model atmospheres with 1/10 solar metal abundance. The results for the effective temperatures and surface gravities will be compared with the results derived for the lightly reddened Milky Way supergiants.